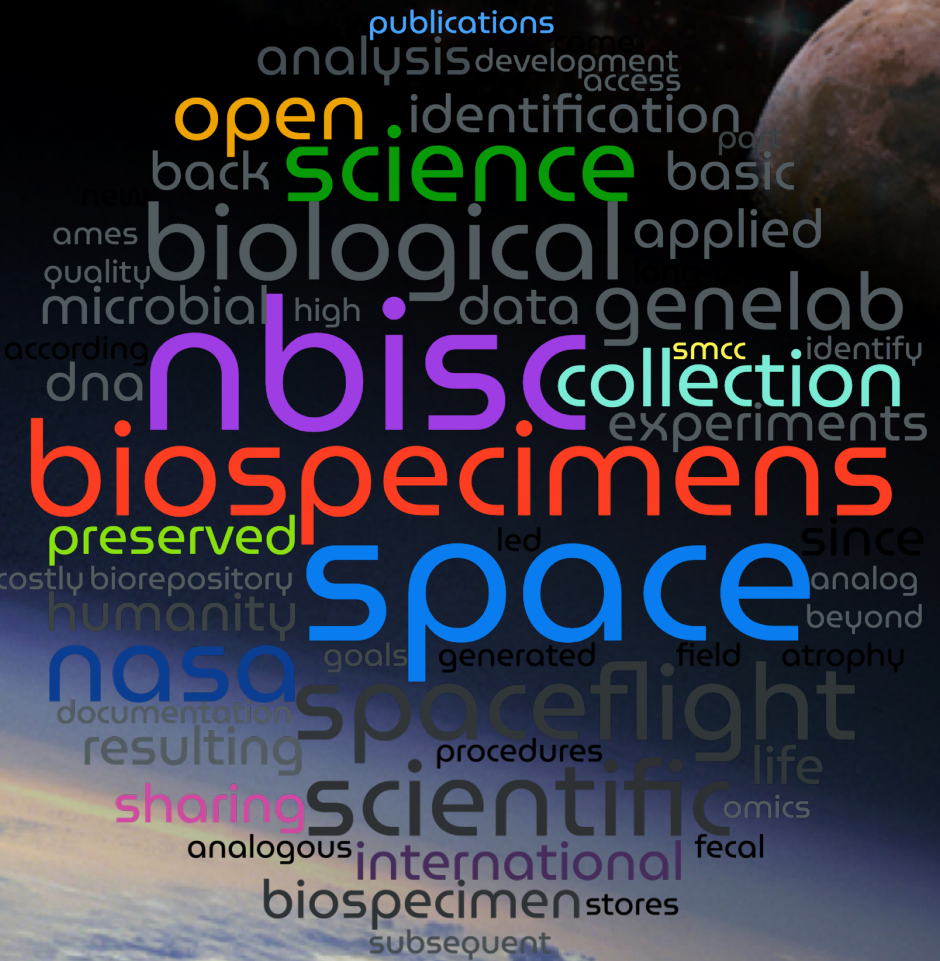
Enabling Biological Discovery Through Biospecimen Sharing:

The NASA Biological Institutional Scientific Collection



2022 NASA Human Research Program Investigators' Workshop

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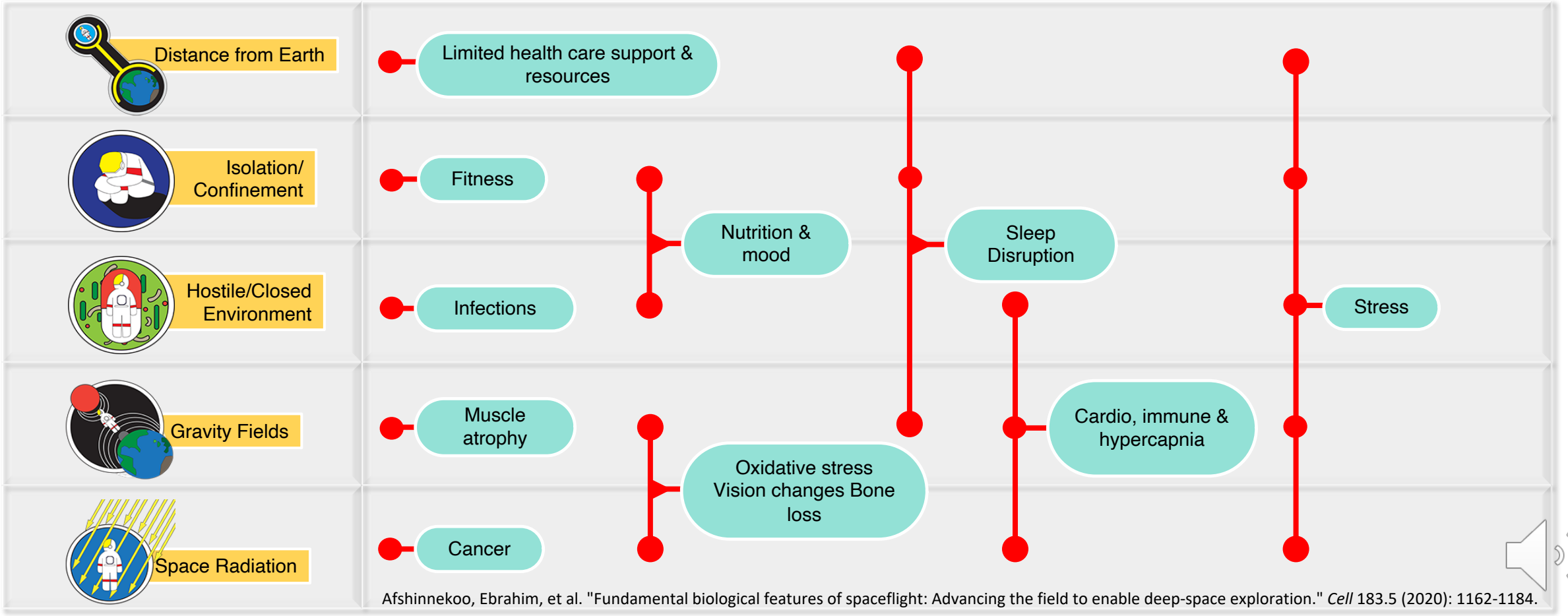
Spaceflight: Hazards and Health Consequences



Afshinnekoo, Ebrahim, et al. "Fundamental biological features of spaceflight: Advancing the field to enable deep-space exploration." *Cell* 183.5 (2020): 1162-1184.

Animals and Model Organisms in Space

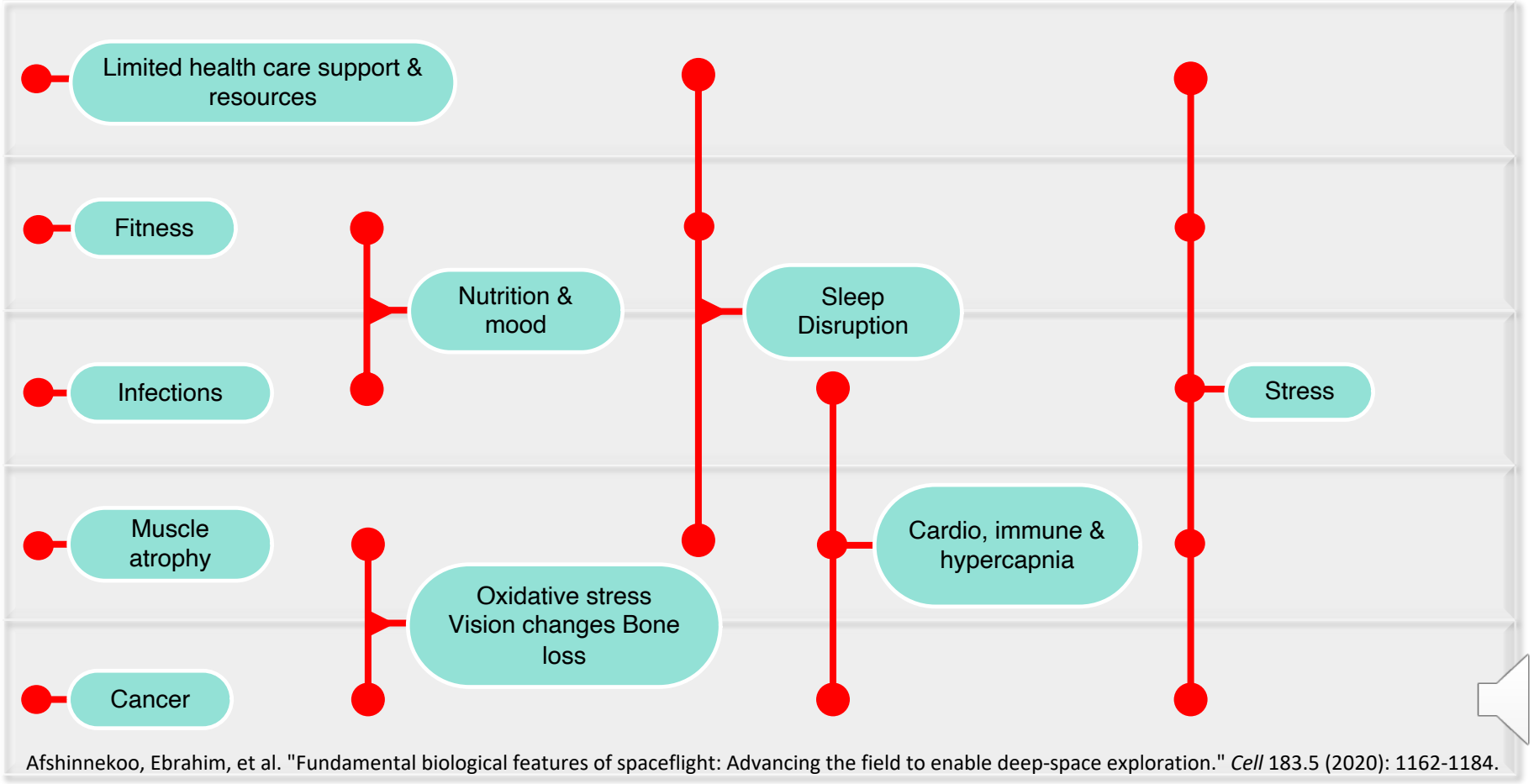
(Taylor Maggiacomo and Alexander Stegmaier, National Geographic, November 2021
https://www.nationalgeographic.com/magazine/graphics/a-visual-timeline-of-every-animal-ever-sent-into-space)

(Ronca, A. E., Souza, K. A., Mains, R. C., Smith, J. D., & French, A. J. 2015.
Translational Cell & Animal Research in Space 1965-2011
https://www.nasa.gov/sites/default/files/atoms/files/nasa-sp-2015-625.pdf)

Spaceflight: Developing Countermeasures

Mice & Rats

Fruit Flies



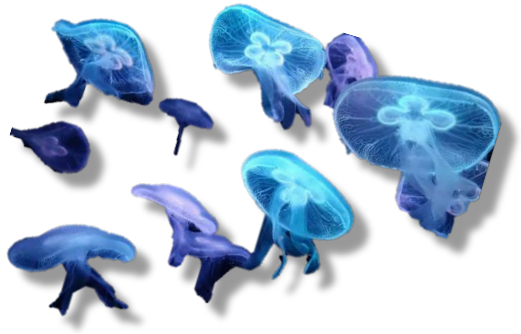
Afshinnekoo, Ebrahim, et al. "Fundamental biological features of spaceflight: Advancing the field to enable deep-space exploration." *Cell* 183.5 (2020): 1162-1184.

Spaceflight: Developing Countermeasures with Model Organisms

Mice & Rats

African Clawed Frog

Jellyfish



Fruit Flies

Oyster Toadfish

Snails

Biospecimen Collection to NBISC

Mice & Rats

What is the NBISC?

A NASA Open Science biorepository of spaceflight and ground analog biospecimens.

What is its purpose?

To further space life sciences research by making these biospecimens available to the scientific community.

Who can use these biospecimens?

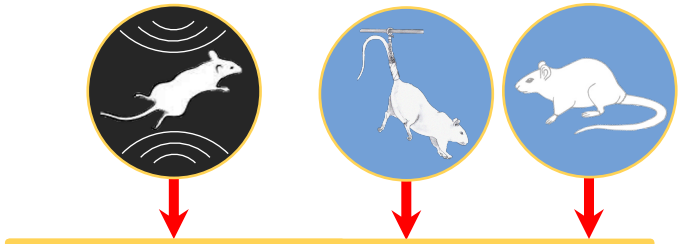
Any researcher with an approved short proposal.

More about this biorepository…

NASA Biological Institutional Scientific Collection

Spaceflight

Ground Analogs



Metadata

Specimens

SLIMS

NBISC

Sharing

~35,000 Non-Human Biospecimens*

- Spaceflight and Ground Analog
- Mouse, Rat, Quail, Microbial isolates (expected)
- Searchable catalog (LSDA Website)
- Requests via LSDA Biospecimen Request form

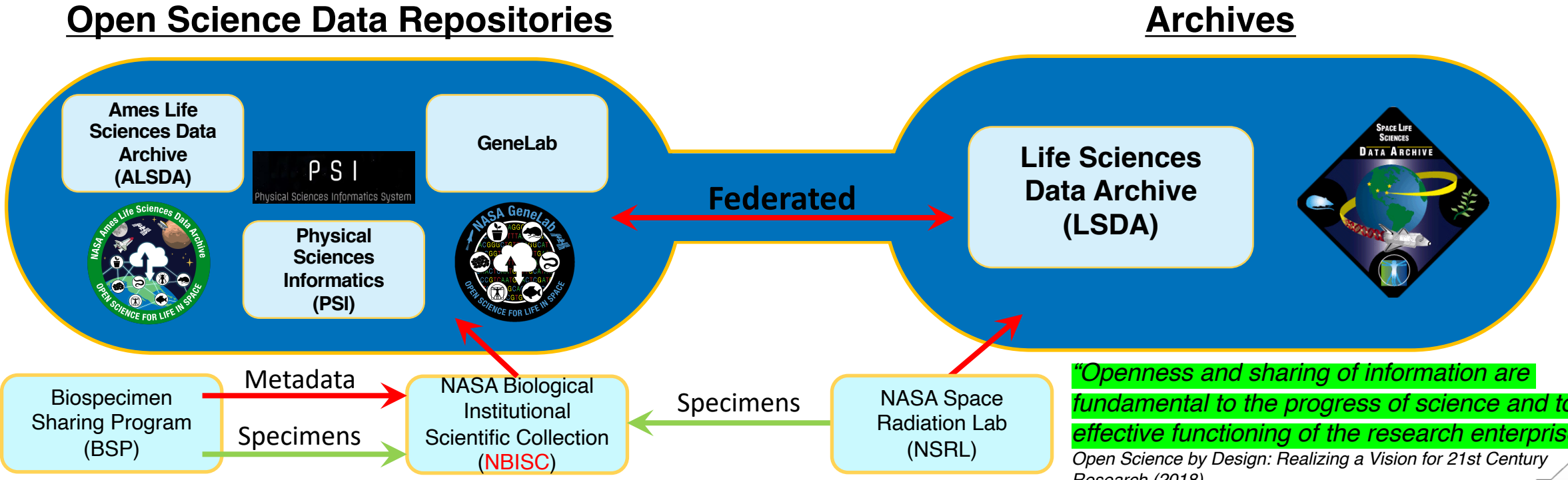
Resulted in:

- 33 publications since 2011
- 53 tissue requests since 2016
- 41 GeneLab data sets

- Fills spaceflight knowledge gaps
- Increases scientific return
- Publications for early career PIs
- Broadens our scientific community
- International collaboration

*Specimens mostly from Shuttle and ISS missions. Also stored are specimens from ground analog studies including centrifuge, hind-limb unloaded and partial weight bearing.

Open Science, Data and NBISC



"Openness and sharing of information are fundamental to the progress of science and to the effective functioning of the research enterprise."

Open Science by Design: Realizing a Vision for 21st Century Research (2018)

NBISC is a cooperative effort of the Space Biology Program and Human Research Program and is part of NASA's Life Science Data Archive (LSDA). Under the 'Open Science' initiative projects, NBISC functions as a resource for storing non-human specimens from spaceflight investigations and correlative ground studies.

Biospecimen Request and Award Process

Request Criteria:

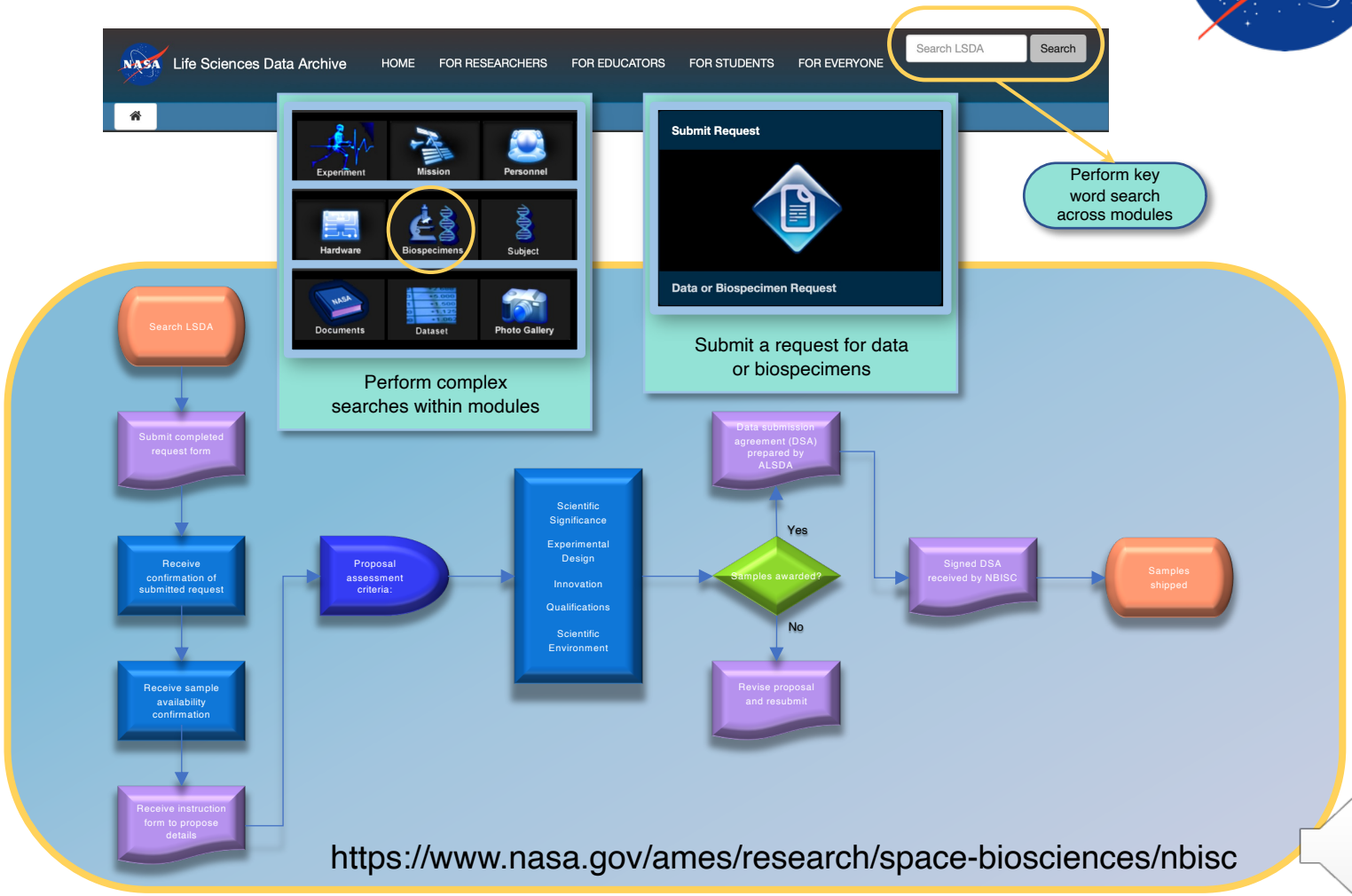
- 8-12th & Community College Educators
- Bioscience Researchers (Domestic/International)
- Must be fully funded to support research

Request Process:

- Search LSDA public website
- Complete and submit online request form
- Complete a 2–3-page proposal

Award Process:

- Merit based
- ALSDA prepares Data Submission Agreement (DSA)
- Requestor signs and returns DSA

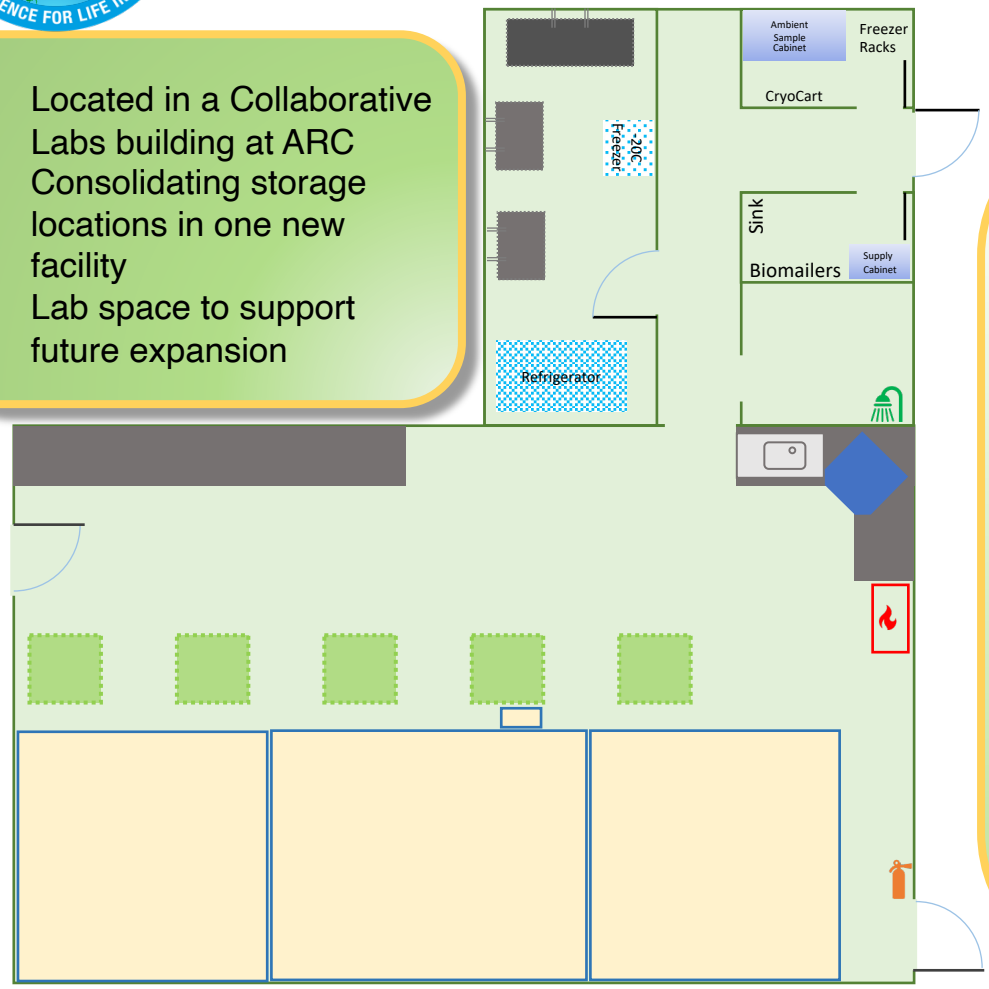


NBISC Facilities and Management

- Secure Facilities
- SLIMS Inventory Management System
- Metadata capture: Conditions, Tissue Type, Descriptions, Species, Fixation, Treatments, Chain of Custody Record, Location
- Storage: -86°C, -20°C, +4°C, Ambient
- Empty Back-up Freezers
- Emergency Power Backup
- Alarm System for Freezer Failure and Temperature Monitoring
- Emergency Response: Staff On-Call 24/7
- Standard Operating Procedures (SOPs)
- Requests reviewed by a Scientific Review Board

In Development: NBISC's New Home

- Located in a Collaborative Labs building at ARC
- Consolidating storage locations in one new facility
- Lab space to support future expansion



Recent additions to compliment existing storage and processing capabilities:

Sterling SU780XLE

- Two state-of-the-art Ultra-Low Temperature (ULT) freezers capable of storing 600 standard 2" boxes

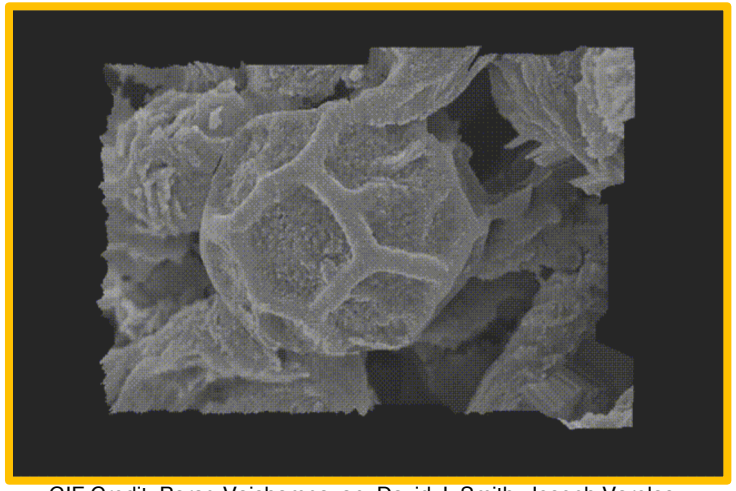
MVE CryoCart

- Providing a controlled and safe environment while transporting samples throughout the facility

On the Horizon…
Space Microbial Culture Collection (SMCC)
NASA Space Radiation Laboratory (NSRL)

SMCC:

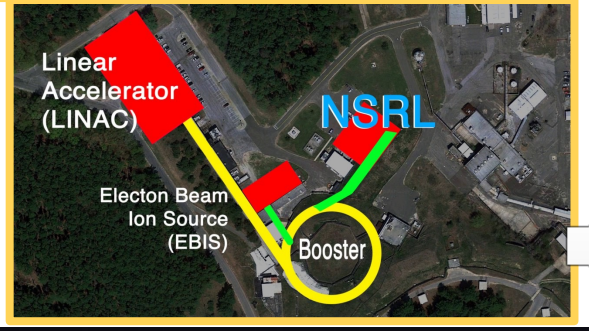
- Consolidation and safeguard of microbial isolates across NASA Centers
- Initial ingest includes bacteria, fungi and yeast
- Collection to include material across NASA programs and directorates:
  - Planetary Protection
  - ISS
  - Astrobiology, Exobiology, Synthetic Biology



GIF Credit: Parag Vaishampayan, David J. Smith, Joseph Varelas

NSRL:

- Initiative to safeguard tissues exposed to simulated cosmic radiation
- Initial ingest from 14 PI investigations
- Establish ARC as a Radiation Biology Center for non-human biospecimens



Thank You

ALSDA/NBISC Team:
Alison French, Danielle Lopez, Alan Wood, Ryan T. Scott, Evelyn Wong, Ahleah Rohr Daniel Parag Vaishampayan

Biospecimen Sharing Program Team:
America Reyes-Wang, Rebecca A. Klotz

Thanks to the Human Research Program, Space Biology Program, and International Space Station